TENA OBJECT MODELING TOOL

Evaluation Report

Prepared by

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PURPOSE

The purpose of this report is to evaluate a list of candidate object modeling tools capable of scripting detailed scenarios and comparing those scenarios to the existing TENA object model. As outlined in the tasking letter distributed at the TENA planning meeting of 13 February 1997 (conducted at the TEC building at Alexandria, VA), the goal of this tool is to "…build an executable model of the TENA Object Model Conceptual View and execute each of the scenarios supplied by the Scenario Generation group. The goal is to identify objects, operations, or attributes which need to be added or modified to execute the representative scenario. (Using this tool,) the collection of scenarios will also identify objects, operations, or attributes which do not seem necessary in the model…"

To accomplish this product evaluation, the Fort Huachuca model validation team performed the

following steps. The team:

1.   Created a matrix of criteria used to evaluate each tool.

2.   Subjectively weighted each criterion to determine importance.

3.   Canvassed sources and compiled a list of candidate products which may potentially achieve the goal.

4.   Using the criteria matrix, compiled a numerical score for each candidate.

5.   Formally reported the findings and provided a recommendation.

The criteria used to evaluate the candidates along with a brief description and the relative weighting of each are listed in Table 1.

Table 1. Weighted Criteria

Weight	Name	Description
5	SCENARIO SCRIPTING CAPABILITY	The ability of the candidate tool to permit the creation and execution of the detailed scenario.
4	MODELING TECHNIQUES SUPPORTED	The ability of the candidate tool to support various object modeling techniques (e.g., UML, OMT).
4	REPORTING CAPABILITY	The ability of the product to graphically or tabularly report correlation, differences, and/or coverage resulting from comparisons between scenarios and models.
3	DOCUMENTATION	The quality of the product's supporting documentation.
3	GRAPHICS CAPABILITY	The ability of the candidate tool to present results graphically; i.e., in an easily understood manner.
3	PRODUCT COST	The purchase price of the tool under consideration.
2	CUSTOMER SUPPORT	The quality of customer support once the product has been procured.
2	EASE OF USE	The ability for a novice user to "spin up" on the use of the product.
2	IMPORT CAPABILITY	The ability for the candidate to import and translate the existing TENA model into its own protocol.
2	PLATFORM FLEXIBILITY	The ability of the candidate tool to operate on a variety of platforms.
1	DEMONSTRATION RESULTS	The results of any kind of demonstration attempted

associated with the product.

BACKGROUND

Object-oriented modeling and design is a relatively new way of thinking about problems organized around real-world concepts. The fundamental concept, of course, is the object, which combines both data structure and behavior in a single object. Many analysts and designers see object-oriented modeling as the emerging wave of the future and numerous people -- Coad, Schlaer, Mellor, et. al. -- seem to be jockeying for position to try to make their mark on the industry. Since 1990, however, three individuals -- James Rumbaugh, Grady Booch, and Ivar Jacobson -- have emerged as leaders in the object-oriented modeling and design world and have established standards which clearly serve as the baseline to which all other techniques are compared.

A fourth individual -- Bob Brown, creator of the IDEF1X data modeling technique -- is also impacting the industry with his $IDEF_{Object}$ object modeling approach. IDEF1X has already been mandated as the DoD data modeling standard and one could assume that $IDEF_{Object}$, an extension of the IDEF1X standard, controls the inside track to follow suit in the DoD object modeling world. Brown is currently working on an $IDEF_{Object}$ IEEE standard as a participant in the IEEE 1320.2 Standards Committee. However, the $IDEF_{Object}$ standard is still under development, and no commercial $IDEF_{Object}$ modeling tool exists to date. Accordingly then, Rumbaugh, Booch, and Jacobson techniques currently dominate the object-oriented modeling and design spotlight.

Rumbaugh, Booch, and Jacobson have each put a slightly different emphasis on his approach to object modeling. James Rumbaugh, whose object modeling methodology is referred to as the *Object Modeling Technique (OMT)* contends that object model development consists of four stages: analysis, system design, object design, and implementation. To complement these four stages of development, the OMT methodology uses three kinds of models to describe a system: Object Model, Dynamic Model, and Functional Model. The existing TENA Object Model is an example of an OMT Object Model; it characteristically describes the static structure of system objects along with their relationships. The dynamic OMT model describes aspects of a system which change over time. Event trace diagrams depicting how a scenario is executed by objects in the object model are an integral part of the OMT Dynamic Model. The Functional Model describes data value transformations in the system using data flow diagrams.

Grady Booch views object-oriented design as "…the method that leads us to an object-oriented decomposition; object-oriented design defines a notation and process for constructing complex software systems, and offers a rich set of logical and physical models with which we may reason about different aspects of the system under construction…" Like Rumbaugh, Booch suggests that object-oriented design centers around the Object Model, consisting of objects and relationships, although the syntax used to represent the Object Model differs from that offered by the OMT approach. Booch suggests using six types of diagrams to represent the Object Model. Class and object diagrams provide a static, logical representation. Module and process diagrams provide a static, physical representation. Finally, state transition and timing diagrams provide a dynamic view of the object model.

Ivar Jacobson also suggests that object-oriented design centers around the Object Model as part

of his OOSE methodology. Unlike Rumbaugh and Booch, however, Jacobson emphasizes the use of object-oriented technology to support business re-engineering. Accordingly, he promotes the use of two kinds of model: the Use Case Model and the Object Model. Jacobson's Use Case Model, for which he is renowned, consists of actors (which interact with the business) and use cases (which are a flow of events that an actor wants performed in the business). Jacobson defines a scenario as a use case instance. Jacobson contends that the creation of the Use Case Model to establish requirements is the first step toward object-oriented design. The second step is to progress from the Use Case Model and create a full Object Model using three types of objects: interface objects, control objects, and entity objects.

A few years ago, Rumbaugh, Booch, and Jacobson joined forces as members of Rational, Inc. The result of this collaboration was a new "modeling language" that Rational advertises as the answer to everyone's needs. This Unified Modeling Language (UML) also included contributions from other methodologists, software vendors, and users. The UML adopted Jacobson's use case diagramming techniques as well as scenario diagramming techniques including sequence diagrams (very similar to the OMT event trace diagram) and collaboration diagrams.

While the work of Rumbaugh, Booch, and Jacobson is not the only approach to object-oriented modeling and design, it is reasonable to state that their techniques are currently ahead of the pack with respect to setting the pace in the object-oriented modeling and design world. Accordingly, of the 11 criteria used to evaluate the products, the ability of the candidate to use industry-standard modeling and diagramming techniques and effectively report results was rated second only to the ability to script scenarios and compare them to the object model. System documentation quality, the ability to graphically display results, and product cost rounded out the top six criteria.

One final issue deserves mention. Within the scope of this study, it was impossible to develop an in-depth working knowledge of each of the candidate products. The results of this task are based on demonstrations, documentation, web site information, personal contact with vendors, and interviews with individuals who either use or have used an older version of the product. One point that consistently comes across is that there is no "magic" way of *informally* implementing a scenario and have it "run through the paces" of automatically flushing out missing requirements. What can be done, however, is to systematically create one or more forms of detailed scenario diagrams which demonstrate interaction between objects and automatically correlate to objects, attributes, and methods which exist in the object model -- in turn identifying missing components required to execute the detailed scenario.

SUMMARY of FINDINGS

Eight commercial object modeling tools were evaluated based on recommendations provided by TENA team members, independent sources, and available literature. *System Architect 4.0* by Popkin, Inc. and *Rational Rose 4.0* by Rational, Inc. emerged as the two leading candidates to achieve the validation goals. The results of the product evaluation are summarized in the table and graph presented in Figure 1.

Candidate	Version	Manufacturer	Total Score
SYSTEM ARCHITECT	4.0	Popkin, Inc.	229
RATIONAL ROSE	4.0	Rational, Inc.	216
OBJECT DOMAIN	1.19	Object Domain Systems	184
TOGETHER/C++	2.1	Object International	167
OBJECTIME	5.0	ObjecTime, Inc.	120
VISIO	5.0	Visio, Inc.	115
RETHINK	Unknown	GENSYM	115
OOWIN	1.0	Logicworks, Inc.	31

DETAILED FINDINGS

The detailed evaluations are presented in Enclosures 1 through 3. Enclosure 1 provides an overview of each of the eight products and the total score assigned to each. The report is sorted by score. The overviews are primarily based on web site information and literature provided by the commercial vendors. Enclosure 2 provides a detailed breakout of how each product was rated based on the individual criteria. Each criterion score has a range of 1 through 10, where 10 is the maximum allotted. Each criterion is weighted on a scale of 1 through 5, where 5 is the maximum allotted. The Evaluation Report is sorted alphabetically by candidate name. Finally, Enclosure 3 summarizes the strongest and weakest features of each product.

Scenario Generation

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Summary Report

Candidate	Version	Description	Total Score
SYSTEM ARCHITECT	4.0	SA Object, System Architect's object-oriented analysis and design module,	

enables you to perform   229

recursive analysis, design, and implementation of your system using your choice of the leading

object-oriented methodologies:

•Booch

•OMT/Rumbaugh

•Shlaer/Mellor

•Coad/Yourdon

•Jacobson Use Cases

You can select a methodology to use or brew your own by selecting a combination of diagram types from various methodologies. For example, you can use Jacobson Use Cases to find the objects in your system, use a Booch Class Diagram as the main static analysis diagram for your system, use OMT Event Trace and Event Flow Diagrams to model scenarios in the system and the messages being passed between objects, and use Shlaer/Mellor State Diagrams and Action Data Flow Diagrams to model the dynamic behavior of classes in the system. SA Object's code generation and importing capabilities enable you to perform recursive analysis and design of your system using an object-oriented class-type diagram (OMT Object Diagram, Booch Class Diagram, or Shlaer/Mellor Information Model). You don't have to do all of your analysis at once; you just analyze a piece of the system, add design details to the diagram, and implement it by generating C++ header (.HPP) and skeleton (.CPP) files. You can make design changes to your code, and then import that code (.HPP file) back into the class-type diagram and let System Architect automatically update the diagram to reflect the code. You then continue adding analysis and design details to the diagram, implement it again, and continue through the cycle until you are satisfied with your design.

RATIONAL ROSE   4.0   The Rational Rose® product family is designed to provide the software developer with a complete set of   216

visual modeling tools for development of robust, efficient solutions to real business needs in the client/server, distributed enterprise and real-time systems environments. Rational Rose products share a

common universal standard, making modeling accessible to nonprogrammers wanting to model business processes as well as to programmers modeling applications logic. Rational Rose/C++, a visual modeling tool, is specifically designed for C++ developers who need to keep their visual application models synchronized with their implementation. Designers are supported in component management and can utilize components for their application assembly in C++ design. Rational Rose/C++ has all the functionality of Rational Rose Modeler, with additional support for C++, including support for round-trip engineering to various C++ environments and for leading C++ class libraries and frameworks.

Enclosure 1 Page 1 of 3

Candidate	Version	Description	Total Score

OBJECT DOMAIN 1.19 Object Domain is a software development tool for object-oriented analysis and design. It is both powerful 184

and affordable with many of the features found in CASE tools costing much more. It fully supports the latest Booch methodology and notation as well as OMT class and state diagrams. An embedded scripting language (TCL) allows custom code and documentation generation. In addition to the the modeling and diagramming tool, we also include the C++ Analyzer, an application to reverse engineer C++ code into class diagrams. Object Domain is a 32-bit application that runs under Windows 95, Windows NT, and Windows 3.1/3.11 with Win32s.

TOGETHER/C++ 2.1 Together/C++ is a powerful design and development environment that bridges the chasm between design 167

and implementation that has traditionally plagued CASE tools. Together/C++ provides a robust object modeling and design tool that accelerates development by silently generating syntactically correct C++ code as a designer manipulates the object model. Thus, the hand-off from design to development is actually the framework for the project itself.

Together C++ uses an innovative approach to C++ code generation and reverse-engineering. The tool uses the source code as the repository. Together C++ generates C++ code for every diagram element, on-the-fly and from within the IDE. If you change the source code manually or import new modules into the project, a keystroke makes Together C++ rescan all the files using "fuzzy-parser" technology. Diagrams are always in sync with the source code.

OBJECTIME 5.0 ObjecTime Developer is an object-oriented software development tool designed specifically for 120

event-driven, real-time applications. It is used to build and execute graphical models of event-driven

systems and to automatically convert these models into high performance C++ code. ObjecTime can be used at all stages of the software development life cycle-from requirements and analysis to design and implementation. The software makes it possible for developers to compile, execute, and validate graphical models of real-time systems. Its model-visualization capabilities including animation of state machines and message flow (including message sequence charts), and debugging facilities. And, with ObjecTime Developer 5.0, the software's powerful modeling capabilities have been extended to the implementation phase of product development.

For the first time, developers can build graphical models of their designs and animate these models on both development and target platforms. ObjecTime Developer 5.0 is the only tool that provides such a powerful graphical observation and control capability on the target environment

Candidate	Version	Description	Total Score
VISIO	5.0	Visio Professional–the only software program specifically designed to help you visualize information	115

infrastructures, create superior databases, plan software systems, and analyze business processes. Visio Professional comes with nearly 1,000 network and telecom shapes (including 640 manufacturer-specific shapes) and a complete set of wizards that can automatically:

•Analyze and diagram your corporate network or Web site.

•Reverse-engineer an ODBC-compliant database to create an Entity-Relationship diagram.

•Generate (forward-engineer) a Microsoft Access database based on a diagram.

•Export a UML Static Structure Diagram to the MS Repository for exchange with other CASE tools.

What's more, you'll find all the shapes you need to plan and document software projects. Choose from

object-oriented design methodologies such as UML, Booch, ORM, Rumbaugh, and Schlaer-Mellor, or

data-modeling methodologies, including Bachman, Chen, and Martin. If your job involves planning,

creating or managing information systems and processes, Visio Professional is the ideal tool for you.

RETHINK UnknownGensym's ReThink(r) is a powerful and flexible software tool for re-engineering, analyzing, optimizing, 115

and managing complex business and production processes. It combines object-oriented modeling and

animation to create graphical models that effectively represent the dynamic behavior of business

processes. After building a process model, ReThink's simulation and "what-if?" capabilities allow managers

to optimize the process by exploring different operating scenarios. The validated model can then be put

on line to support intelligent real-time decision making. With ReThink, multiple users can concurrently

develop multi-level object-oriented process models. Computer animation techniques bring process models

to life by showing the flow of information and material as tasks are performed. ReThink users can

simulate and benchmark the performance of proposed operating scenarios in order to test re-engineering

ideas before implementation. Complex questions like, "How will restructuring the process impact my

customer response time?" or "How can the overall cost of this process be improved?" can be answered

quickly and directly. Then, the model can be used on line to augment existing enterprise information

systems with intelligent decision support.

OOWIN 1.0 OOWIN/CRC is an object-oriented design tool for developing responsibility-driven models that define 31

how objects behave and interact. OOWIN is no longer being marketed by Logicworks, Inc. OOWIN

features have been incorporated into Rational

Scenario Generation

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
OBJECT DOMAIN	1.19					
		SCENARIO	3	5	15	Object Domain documentation indicates there is a capability to create Interaction Diagrams to show the execution of a scenario, but only as "...basically the same information as the Object Diagram but organized differently."
		REPORT CAPABILITY	2	4	8	Available documentation indicates there is an ability to "generate documentation," but does not provide confidence that the reporting capability is sufficient to support TENA requirements.
		MODEL TECHNIQUES	7	4	28	Object Domain gets points for using industry standard modeling techniques -- OMT and Booch. Toggling back and forth from OMT to Booch seems very straightforward. The product appears to be capable of displaying diagrams as Class Diagrams, State Transition Diagrams, Object Diagrams, Interaction Diagrams, Module Diagrams, and Process Diagrams.
		DOCUMENTATION	5	3	15	Documentation investigated includes web page information and the help file available with the demonstration product. The help file included with the demo application is a bit weak.
		GRAPHICS	8	3	24	Object Domain emphasizes its graphics capabilities

				as part of its ease of use attribute.

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
COST	9	3	27			Inexpensive product. Registration cost for the shareware product is $99.00.

Scenario Generation

Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
CUST SUPPORT	5	2	10			Interface with customer support has not been required to date.
EASE OF USE	8	2	16			Object Domain appears to be reasonably easy for a novice user to learn to use. In fact, this issue and its inexpensive cost is clearly pointed out on the web page.
IMPORT	10	2	20			Strongest feature for the TENA application. No need to import, since the existing model is in Object Domain.
PLATFORM	7	2	14			Documentation is unclear what platforms the product runs on, although it definitely runs on the Intel 586 Windows chip.
DEMO	7	1	7			The Object Domain demonstration consists of an easily obtainable, straightforward, downloadable, executable version of Object Domain 1.19. A textual tutorial is also available.

Total Score: **184**

Scenario Generation

Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
OBJECTIME	5.0					
SCENARIO	4	5	20			Conversations with technical representatives
						indicate "...we could probably do something like
						what we're attempting to do.." Emphasis lies
						clearly on real-time software development.
						Supports a scenario generation technique called
						"message sequence charts."
MODEL TECHNIQUES	1	4	4			ObjecTime uses proprietary modeling techniques
						to graphically model real-time software
						development projects. From the web page,
						"ObjecTime Developer is an object-oriented
						software development tool designed specifically
						for event-driven, real-time applications. It is used
						to build and execute graphical models of
						event-driven systems and to automatically
						convert these models into high performance C++
						code." Does not support OMT, Booch, UML, or
						Jacobson techniques.
REPORT CAPABILITY	3	4	12			ObjecTime does not support Jacobson Use Case or
						scenario techniques. While reporting capabilities
						do exist, and a "message sequence chart" capability
						also exists, the scenario scripting goal does not
						appear to be as strongly supported by this product

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
						as by other candidates.
GRAPHICS	8	3	24			For the correct application -- real-time software development -- the graphics capability appears to be very capable. Features animated state machine diagrams.
DOCUMENTATION	5	3	15			Documentation research centered around the web page. Difficult to evaluate. Other factors likely preclude the product as a valid candidate.

Scenario Generation Tool Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
COST	2	3	6			Prohibitively expensive. Per the sales representative, one license of ObjecTime costs $25,000.
IMPORT	1	2	2			Based on information available on the web, ObjecTime apparently does not support OMT, Booch, or UML techniques. Unlikely to be compatible with existing model.
CUST SUPPORT	5	2	10			Interface with customer support has not been required to date.
EASE OF USE	6	2	12			Based on the demonstration, ObjecTime appears to be reasonably easy to use -- specifically in a real-time software development environment. It appears to have a nice real-time software code generation capability.
PLATFORM	4	2	8			Apparently does not run on Windows 95; does run on Windows NT and UNIX.

DEMO	7	1	7	The ObjecTime demonstration is run from the
				web. The demonstration is well done, although it
				does not permit hands-on interaction by the user.

Total Score: **120**

Scenario Generation

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
OOWIN	1.0					
SCENARIO	1	5	5			OOWIN is no longer being marketed by
						Logicworks. OOWIN has been incorporated by
						Rational as part of the CRC modeling solution.
REPORT CAPABILITY	1	4	4			OOWIN is no longer being marketed by
						Logicworks. OOWIN has been incorporated by
						Rational as part of the CRC modeling solution.
MODEL TECHNIQUES	1	4	4			Extremely limited. Apparently supports "Class,
						Responsibility, and Collaboration (CRC)" style
						data modeling only at this time.
COST	1	3	3			OOWIN is no longer being marketed by
						Logicworks. OOWIN has been incorporated by
						Rational as part of the CRC modeling solution.
DOCUMENTATION	1	3	3			OOWIN Documentation comes in a typical
						package consisting of a User's Guide and Methods
						Guide.
GRAPHICS	1	3	3			OOWIN is no longer being marketed by
						Logicworks. OOWIN has been incorporated by
						Rational as part of the CRC modeling solution.

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
CUST SUPPORT	1	2	2			OOWIN is no longer being marketed by Logicworks. OOWIN has been incorporated by Rational as part of the CRC modeling solution.
IMPORT	1	2	2			OOWIN is no longer being marketed by Logicworks. OOWIN has been incorporated by Rational as part of the CRC modeling solution.

Enclosure 2

Scenario Generation Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
EASE OF USE	1	2	2			OOWIN is reasonably easy to load, use, and come up to speed on.
PLATFORM	1	2	2			OOWIN is no longer being marketed by Logicworks. OOWIN has been incorporated by Rational as part of the CRC modeling solution.
DEMO	1	1	1			A copy of OOWIN is available in-house, and has been loaded and examined.

Total Score: **31**

Enclosure 2

Scenario Generation Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
RATIONAL ROSE	4.0					

SCENARIO	8	5	40	Rational Rose clearly demonstrates a capability to
				create Jacobson use cases and sequence tables
				which in turn have the capability of being
				correlated with object elements.
REPORT CAPABILITY	6	4	24	Rational's "SoDA" reporting capability allows the
				user to "...capture use cases and scenarios and
				relate them to the appropriate elements of Rose
				models...SoDA can generate tables correlating use
				cases and scenarios and the corresponding
				elements of Rose." This reporting capability was
				not demonstrated in the demo version, but was
				outlined in 3.0 documentation. SoDA is an
				optional reporting feature.
MODEL TECHNIQUES	9	4	36	Rational Rose demonstrates great flexibility in its
				ability to handle different front-line object
				modeling techniques -- OMT, Booch, UML, and
				Jacobson techniques -- as witnessed by the fact
				that Rumbaugh, Booch, and Jacobson are all on
				the Rational staff. Rational also has a teaming
				agreement with Logicworks, Inc. and is developing
				a link between Rose and BPWin as well as Rose
				and ERWin. Rational has incorporated the
				features of Logicworks OOWin/CRC.

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
GRAPHICS	9	3	27			Rational Rose provides excellent graphics support, including the capability to present several types of UML diagrams such as Use Case Diagrams, Class Diagrams, Interaction Diagrams, and Component Diagrams -- all a part of what Rational refers to as its "round trip engineering (RTE) approach." RTE consists of code generation, reverse engineering, design differencing, and model merging. Together these capabilities allow developers to keep their models in-synch with their code throughout the life of a project, supporting complete leverage of the OO paradigm.
DOCUMENTATION	7	3	21			Rational Rose 3.0 documentation is available for inspection in-house. Rational Rose documentation for 3.0 comes in a typical package consisting of Application Notes, a Methods Guide, and a document called "Round Trip Engineering using C++."
COST	4	3	12			A copy of Rational Rose/C++ 4.0 and SoDA combined costs appx $4400.00. Rose/C++ costs $2400.00 and SoDA (optional) costs $1995.00.
EASE OF USE	3	2	6			While apparently very capable in its ability to

model using Booch, OMT, and UML notation, one of the negatives involving Rational Rose is its complexity and inability to be used quickly by the inexperienced user. The demonstration version does not give the user an increasingly warm feeling in this area. However, ease of use is something one sometimes sacrifices in favor of capability.

Scenario Generation Tool Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
CUST SUPPORT	7	2	14			The interface with customer support during this effort involved e-mail exchange followed by phone calls from the company. Follow-up from Rational was responsive.
IMPORT	8	2	16			Because Rational Rose is constructed around C++, and Object Domain -- the product used to create the existing model -- creates C++ code, it would appear that the existing model could be "easily" imported into Rational Rose.
PLATFORM	7	2	14			Information received to date indicates appropriate platform flexibility, including all Windows and NT platforms.
DEMO	6	1	6			The Rose 4.0 demonstration involved a downloaded limited version of the full-blown product. The demo copy was informative, although the "walkthrough" was a bit difficult to follow. The demo did include instruction on how

to create use case diagrams and sequence diagrams.

The sequence diagram, as Rose calls it, is the event trace diagram used in the creation of the high level scenarios.

Total Score: **216**

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Scenario Generation Tool Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
RETHINK Unknown						
SCENARIO	4	5	20			Rethink demonstrates both a scenario and real-time analysis capability. Apparently does not support OMT, Booch, Jacobson, and/or UML techniques, thus limiting its value in the TENA context.
MODEL TECHNIQUES	1	4	4			Rethink uses proprietary modeling techniques to graphically model real-time software development projects.
REPORT CAPABILITY	3	4	12			Reporting capabilities exist. Based on information on the web, Rethink reporting techniques are apparently not applicable to TENA requirements.
COST	1	3	3			No pricing information available.
GRAPHICS	8	3	24			Based on information derived from the homepage, RETHINK appears to have a very impressive graphics capability when used in support of the proper application.
DOCUMENTATION	5	3	15			Documentation investigated centered around the

web page. Difficult to evaluate, but other factors

likely preclude the product as a valid candidate.

Criterion	Score	Weight	Weighted Score	Comments
EASE OF USE	6	2	12	Based on information derived from the web page, RETHINK appears to be reasonably straightforward when used in support of the proper application.
CUST SUPPORT	3	2	6	Customer support, specifically solicitation of pricing information, has been unresponsive to date.

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Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
PLATFORM	8	2	16			Information received to date indicates appropriate platform flexibility, including all Windows and NT platforms as well as UNIX.
IMPORT	1	2	2			Based on information available on the web, Rethink apparently does not support OMT, Booch, or UML techniques. Unlikely to be compatible with existing model.
DEMO	1	1	1			No demonstration copy of RETHINK was located.
Total Score:	**115**					

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
SYSTEM ARCHITECT	4.0					
SCENARIO	8	5	40			Based on the web demonstration, the ability to create Jacobson use cases and OMT event trace diagrams appears to be robust and well integrated.
MODEL TECHNIQUES	8	4	32			System Architect demonstrates great flexibility in its ability to handle different front-line object modeling techniques -- OMT, Booch, UML, and Jacobson techniques. Also supports event trace diagrams. As an added feature, apparently has a nice interface (additional cost) to data models (IDEF1X & IE) and process models (IDEF0).
REPORT CAPABILITY	6	4	24			Based on available information, reporting capability appears to be standard.
COST	8	3	24			Inexpensive based on the fact that the TENA project already owns a registered copy. The upgrade from our existing version 3.1a to version 4.0 costs less that $1000.00.
DOCUMENTATION	7	3	21			Documentation investigated includes web page information and the help file available with the demonstration product. Version 3.1a documentation is available in NUWC and will be shipped to Fort Huachuca for inspection.

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
GRAPHICS	8	3	24			Based on the web based demo, graphical representation of class diagrams, use case diagrams, event trace diagrams, and transition state diagrams appear robust and well integrated.

Scenario Generation

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
CUST SUPPORT	7	2	14			The interface with customer support during this effort involved e-mail exchange followed by phone calls from the company. Follow-up from Popkin was responsive.
EASE OF USE	7	2	14			Based on the web demonstration, the product appears to be straightforward and offers the typical Windows type features.
PLATFORM	6	2	12			Information received to date indicates appropriate platform flexibility, including all Windows and NT platforms.
IMPORT	8	2	16			Because System Architect is constructed around C++, and Object Domain -- the product used to create the existing model -- creates C++ code, it would appear that the existing model could be "easily" imported into System Architect.
DEMO	8	1	8			The demo was impressive. While a demo CD-ROM was supposed to be sent via mail and was not (due to unavailability), the major features of

System Architect were demonstrated via animated

walkthroughs downloaded from the web. They

were complemented with audio instruction and

were easy to follow and entertaining.

Total Score: **229**

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Scenario Generation

Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
TOGETHER/C++	2.1					
SCENARIO	4	5	20			Apparently, only Coad formatted scenarios are available which somewhat limits scenario generation capabilities.
REPORT CAPABILITY	5	4	20			Together/C++ features standard reporting capabilities. Not as impressive as some of its competitors.
MODEL TECHNIQUES	7	4	28			Together supports OMT, Unified, and Coad. Scenarios are only available in Coad format. Not as capable in this area as some of its competitors.
GRAPHICS	8	3	24			Based on the web page and demonstration version, OMT, UML, and COAD design techniques appear to be well portrayed graphically.
DOCUMENTATION	7	3	21			The evaluation of Together documentation primarily centers around information available from the web. Documentation, including the help facility, seems robust.
COST	1	3	3			After multiple phone attempts and e-mail

messages, no pricing information is available to

date.

EASE OF USE	8	2	16	Based on information available on the web, the
				product appears to be graphically oriented and
				easy to use.
CUST SUPPORT	2	2	4	Customer support has been very non-responsive.
				Delays in providing requested background
				information and costs have been routine. No
				costing information has been made available.

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
PLATFORM	6	2	12			The product apparently runs on all Windows
						platforms.
IMPORT	6	2	12			Because Together/C++ is constructed around C++,
						and Object Domain -- the product used to create
						the existing model -- creates C++ code, it would
						appear that the existing model could be "easily"
						imported into Together/C++.
DEMO	7	1	7			A limited version is available for download from
						the web. Together/C++ features a robust tutorial
						provided as part of the help feature.

Total Score: **167**

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Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
VISIO	5.0					
SCENARIO	1	5	5			Documentation review indicates no capability to script scenarios or event trace diagrams.
REPORT CAPABILITY	2	4	8			VISIO does not support Jacobson Use Case or scenario techniques. While reporting capabilities do exist, the scenario scripting goal does not appear to be supported.
MODEL TECHNIQUES	2	4	8			VISIO uses proprietary modeling techniques which do not include Booch, OMT, or Jacobson diagramming capabilities.
COST	7	3	21			Inexpensive. A single copy of VISIO Professional costs $275.00.
GRAPHICS	7	3	21			As the name implies, VISIO is very graphically oriented. It's drawing palette appears to be nicely laid out. This is its strongest characteristic.
DOCUMENTATION	5	3	15			VISIO 4.5 documentation is robust and consists of: "Introduction," "Developing VISIO Solutions," and "Using VISIO."
EASE OF USE	5	2	10			The VISIO documentation indicates that VISIO models are very graphically oriented, and consequently appear to be reasonably easy to use.
CUST SUPPORT	5	2	10			Interface with customer support has not been required to date.

Scenario Generation

Tool

Evaluation Report

Candidate	Version	Criterion	Score	Weight	Weighted Score	Comments
IMPORT	1	2	2			Based on in-house documentation and web information, Visio features no OMT, Booch, or UML capability. The product is unlikely to be compatible with the existing TENA model.
PLATFORM	5	2	10			Visio appears to run on the appropriate range of platforms, including Intel 586 running Windows.
DEMO	5	1	5			A copy of VISIO is available in-house, and has been loaded and examined.

Total Score: **115**

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Tool

Features Report

Name	Version	Strong Features	Weak Features
OBJECT DOMAIN	1.19	The strongest feature of Object Domain is that it is the product that has been used to implement the existing model. Additionally, the product is very inexpensive.	Object Domain's weakest feature seems to be its inability to represent use cases and scenarios appropriately to satisfy TENA goals.
OBJECTIME	5.0	ObjecTime's graphic presentation capability was its strongest feature.	Designed to support real-time software development projects, ObjecTime does not use any of the standard object modeling techniques. As a result, conversion from the existing TENA model to ObjecTime will be laborious at best. Also, the product is prohibitively expensive.
OOWIN	1.0		

TENA | OOWIN is no longer marketed by Logicworks, Inc. It's CRC | OOWIN is not a serious candidate to accomplish

features have been incorporated as part of Rational Rose. goals.

RATIONAL ROSE 4.0

Rational Rose uses the Rumbaugh, Booch, and Jacobson

modeling techniques; in fact, Rumbaugh, Booch, and

Jacobson are employed by the company. The product's

graphics capabilities appear to be impressive. Documentation

is solid. Customer assistance was very responsive.

Rational Rose is reasonably complex. Some learning

curve will be involved to effectively use the product.

RETHINK   Unknown

Rethink is a highly graphically oriented product which

appears to be reasonably easy to use.   modeling techniques. No demonstration was located to

try it out. Customer support was unimpressive. After

several attempts, no pricing information was available.

Rethink does not support Rumbaugh, Booch, and Jacobson

SYSTEM ARCHITECT   4.0

product;

System Architect makes good use of the standard modeling

process

techniques. It's excellent demonstration program and prompt

vendor-supplied literature indicated that its graphics and   modeling world.

scenario generation capabilities would satisfy TENA goals.

Additionally, the TENA team already owns a previous

version of System Architect, so upgrading to the current

capabilities will be reasonably inexpensive.

Object modeling capabilities are new to the

System Architect has evolved from the data and

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Scenario Generation

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Features Report

Name   Version Strong Features Weak Features

TOGETHER/C++   2.1

Together/C++ is a highly graphically oriented product which appears to be reasonably easy to use.

Scenario generation capabilities and customer support are weak.

VISIO   5.0

As the name implies, VISIO's graphics capabilities are its strongest feature.

VISIO does not support standard object modeling and design techniques. Additionally, VISIO does not provide scenario generation capabilities required to support TENA requirements.

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